organic compounds without having gold's disadvantages of low hardness and strength, and excessive material transfer and welding, especially for higher current values. Gold with CeO_2 has unusually outstanding contact properties, combining high resistance to arc erosion and welding with low and stable contact resistance. These materials can be used wherever gold alloys are now used, such as sensitive relays, key switches, computers, radio frequency tuners, slip rings and brushes, connectors, and telecommunication applications. The superior contact properties of these materials should result in appreciable economic advantages, either by providing improved performance over materials now used by extending the current range or life, or by using less contact material to provide lower cost for comparable performance and life.

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Gold-Chromium Wire for Pressure Gauges

NEW HEAT TREATMENT IMPROVES STABILITY

The anomalously low temperature coefficient of resistance of gold containing approximately 2 per cent by weight of chromium was first discovered by Linde in 1932 (1), and subsequent studies at the U.S. National Bureau of Standards (2, 3) demonstrated that the alloy should be regarded as a superior corrosion resistant alternative to base metal precision resistance alloys such as Manganin. It now finds considerable application in the measurement of high pressures by the Bridgeman technique, where an essential requirement is that any change in resistance caused by temperature variations should be low compared with the pressure induced increment.

The effect of heat treatment on the temperature and pressure sensitivity of gold-chromium wires has, therefore, received a great deal of attention from the gauge manufacturers, although much of the published information has hitherto been rather confusing. Thus, Darling and Newhall (4) found that the resistance of the gold–2.1 per cent chromium alloy increased linearly with applied pressure within limits as close as 0.25 per cent, was stable after repeated pressure applications, showed no hysteresis, and attained equilibrium after a change in pressure more rapidly than Manganin. Boren, Babb and Scott (5), however, reported that the temperature coefficient of gold-chromium changed with every application of pressure and that the alloy showed considerable hysteresis.

Workers at the Institute of Physics, Warsaw Technical University (6), now appear to have hit upon a method of heat treatment which obviates these disadvantages and brings each individual gauge into a highly stable condition. The complete gauge, wound from hard drawn 0.1 mm diameter wire, is aged at 300°C in a silicone oil bath and the resistance constantly monitored. After an initial slow rise in resistance which peaks after 5 to 6 hours, the resistance then begins to fall, and a broad, fairly stable minimum in the resistance/time curve is attained after 12 to 13 hours at temperature. Gauges which had been brought into this resistance minimum range showed the highest degree of pressure stability and the lowest pressure hysteresis. The resistance/pressure characteristics of such gauges were also linear for all pressures up to 6000 bars. The gauges which showed non-linearity and hysteresis were those whose ageing treatment ended before or after the stable minimum in the resistance/time curve had been attained.

Physical metallurgists will naturally endeavour to correlate these physical and electrical parameters with structural changes within the alloy. The equilibrium solubility of chromium in gold is approximately 8 per cent by weight at 200°C (7), and considerably more at higher temperatures. Evidence of grain boundary precipitation in the 2 per cent chromium alloy has, however, been reported (8), although it seems probable that this would be associated with the presence of impurities. The gold-chromium solid solution begins, however, to order below 325°C (9), and crystallographic details of the Ni_4Mo type superlattice which develops after prolonged annealing have been described by Stolz and Schubert (10). It would therefore be of great interest to relate the pressure stability of the heat treated coil with the degree of ordering which has been introduced.

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